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ABSTRACT

The vast underutilization of technology in educational environments suggests the need for more research to develop models to successfully adopt and diffuse computer systems in schools. Of 980 surveys mailed to various Ohio public schools, 529 were completed and returned to help determine current attitudes and perceptions of teachers and administrators toward technology practices in planning (adoption), implementation (diffusion), and evaluation (outcome). The surveys rated the importance of computer orientation, research, communications, community involvement, support, training, followup training, evaluations, outcome, and use. Results illustrate the importance of utilizing technology to improve instruction and administrative productivity, but suggest the fate of technology in schools will depend on its efficiency and effectiveness as perceived by teachers and administrators. Detailed descriptions of methodology, results, and summaries of models commonly applied to educational change are included. (EJS)

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BEYOND COMPUTER PLANNING: MANAGING EDUCATIONAL COMPUTER INNOVATIONS

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by

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BEYOND COMPUTER PLANNING: MANAGING EDUCATIONAL COMPUTER INNOVATIONS

Introduction

During the last decade, schools witnessed a tremendous expansion in acquisition of computers. Yet, as we move into the nineties, school leaders are still facing serious challenges in proper use of the technology in both instruction and the administrative operation of schools (OTA, 1986; Grayck, 1986). Through trial and error, administrators have discovered a basic premise or change theory--purchasing and allocating equipment does not assure adoption and diffusion of new practices.

The National Task Force on Educational Technology (1986) observed: "While educational institutions have made increasingly large investments in educational technology, the technology has often been misused or underused" (p. 22). Similar observations were reported by the Office of Technology Assessment (1986) which found technology is still vastly underutilized in educational environments.

The underutilization issue suggests we need more research to develop models for successfully adopting and diffusing computer technology into educational environments. The problem facing administrators today is not how to purchase computers, but how to manage implementation of computer innovations for faster adoption and diffusion into the school organization. Thus, the major purpose of this article is to examine the attitudes and perceptions of teachers and administrators toward computer innovations as a key to the varying rates of adoption and diffusion of innovative practices

in education. This paper will not attempt to discuss specific computer applications, but provide a conceptual framework for a systematic approach to planning and managing computer innovations in schools.

Data for the paper was obtained from a review of the literature and a study of innovative schools in Ohio. Through a research project at The University of Akron, teachers and administrators were surveyed to determine their perceptions of computer technology practices in the areas of planning (adoption), implementation (diffusion), and evaluation (outcomes). These areas are common elements found in educational change models. Therefore, a brief review of educational change and innovation will be presented to provide the reader with further discussion as background for this paper. Secondly, an overview of the research methodology will be discussed. Finally, the results will be reported as well as implications and conclusions from the study.

Theoretical Framework

Educational Innovations and Change

Technology innovations have been noted as a key component on the reform agenda. Yet, educational organizations have historically been more resistant to innovations and change than industrial or business enterprises, and computer technology innovations are no exception (Nichols, 1983; Tashner, 1984a).

A review of the literature provides evidence that attempts by educators to innovate have not always been successful in spite of considerable innovative activity (Berman, 1978; Gross, 1977; Nichols, 1983). In a study of the Federal Government's efforts to change public education, Gross (1977) found that in nearly every case, the fate of a specific educational innovation in public schools concluded that its anticipated outcomes were not achieved,

its educational benefits were minimum, or that it was not fully implemented. Similar findings were reported by the Rand Corporation in a study for the United States Office of Education on federal programs. The Rand studyconcluded that the decade of innovations and change in the 1960s produced no significant difference in schools or the quality of education (Berman & McLaughlin, 1978).

Everett Rogers (Rogers & Shoemaker, 1971), a leading authority on the process of innovation, summarizes the views of many critics on educational change in his remarks:

> It has been said that this is a time of great innovation but little change in U.S. education. Many new ideas are promoted and adopted, but change in education is almost nil. Many of the innovations are merely educational fads, and after widespread adoption of them, it is difficult to measure an increase in achievement. Many educational innovations with a low degree of relative advantage have been adopted and then discontinued after a short time. (pp. 49-50)

Another key factor influencing changes and innovations in schools has been the traditional slow rate of the adoption and diffusion process. In the past, schools have implemented change through the process of natural diffusion--generally in an unplanned process (Mort, 1969). Mort says schools typically take 50 years to implement a new innovation and another 25 to 50 years to make it a common practice. The kindergarten movement is a benchmark example. By 1960, kindergarten was considered effective for children. In 1967-68, only 46% of schools had implemented kindergarten programs--94 years after their introduction in the U.S. The rate of change has greatly accelerated since Mort's studies but remains a crucial variable in the adoption and diffusion of computer innovations in education.

Defining Change and Innovation

Throughout the literature, change and innovation are often used interchangeably with varied and sometimes conflicting definitions. However, some

theorists have made a clear distinction between the two terms. Huberman (1973) claims the deliberate element of planning distinguishes an innovation from change. In the review of the literature on innovation, Huberman's view is widely supported. There appears to be general agreement about three aspects of innovation: first, that it is basically fundamental in nature; second, that it is deliberate and planned; and third, that there is an intention of improvement (Nichols, 1983).

Another variable identified in defining innovation is the human element. There is a great deal of concern for the human element in most change models applied to education. The very core of the Classical Model associated with Everett Rogers is the adoption of the innovation by the prospective users. For purposes of this paper, the human element (human perception) is of central importance. Secondly, innovation is defined as an idea, object, or practice which is perceived as new by an individual or individuals, intended to bring out improvement in relation to desired objectives, fundamental in nature and is planned, deliberate, measurable, and durable.

Managing Innovation

The definitions of innovation to some degr explain why education systems are resistant to change. The fundamental nature of educational innovations necessitate considerable change in teacher attitudes and often structural changes as well. On this point, Nichols (1983) notes the fact that

> An innovation frequently requires teachers to give up practices in which they feel secure and display high levels of competence and to adopt new practices in which at least temporarily they feel less secure and in which they might possibly be less competent. (p. 4)

Another issue impacting the management of innovations is the difficulty associated with planning. The very idea of planned change is a recent phenomenon in education. For example, a study by the National School Boards Association (1985) reported 85% of computer innovations in schools were unplanned. Though numerous change models have been successfully applied in business and scientific environments, no one model has been successfully developed to meet the needs of educational environments. As Watson (1967) points out, most innovations are introduced sporadically rather than continuously, by outside pressure rather than generated within, and for reasons of expediency, rather than as expression of conviction or deliberate planning. These findings are especially true in education where school systems typically are more preoccupied with the operation of existing programs.

As a result of limited practice, planned change in schools lacks theoretical models. However, three models stand out in the literature as potential theoretical bases for educational change. Havelock (1969), a pioneer in the areas of change and innovation, reviewed 4,000 studies of change in many fields including education and identified three principal models of how change takes place: (a) the Research and Development Model (R&D), (b) Social-Interaction Model, and (c) the Problem-Solving Model (see Table 1).

The three models differ on the source of initiative in the change process. For example, the Research and Development Model stresses the developer, whereas the Problem-Solving Model stresses the communicator and receiver. Another difference pointed out by Huberman (1973) is that the Social-Interaction Model is highly natural, whereas the R&D Model is closely planned. He further explains that the R&D Model studies, in particular, the activities of the resource person, whereas the Social-Interaction Model

focuses on the user and the Problem-Solving Model focuses on the change agent in interaction with the user. Havelock also points out that the dissemination strategies in each model are different: one-way communications in R&D, two-way involvement of sender and receiver in problem solving, and a variety of transmission for the Social-Interaction Model.

The literature suggests there are problems associated with each of the three models. For example, educational innovations developed on the R&D Model may not be appropriate for all schools. Transferability is also a concern in the Social-Interaction Model with problems related to congruence. The Problem-Solving Model, like most school-based innovation, is limited to the resources within the school and often lacks a solid research base (Nichols, 1983).

Another change model commonly cited in the literature is the Classical Model commonly used in technical innovations and associated with the work of Everett Rogers. Rogers (1962, 1971) studied attempts to "communicate" technical innovations in agriculture and other fields over a period of decades. The diffusion process is the key element of this model; but like other diffusion models, user acceptance of an innovation takes time--typically 12 to 15 years in agriculture and even longer in education. Perelman (1987) asserts a major problem with the Classical Model is that the diffusion of innovations concentrated on individual choices and paid little attention to innovation within the organization.

Schon (1971) presents another perspective for models of innovation which more closely fits technological innovation in public schools. His Center-Periphery Model has three basic elements: (a) the innovation to be diffused exists prior to diffusion, (b) diffusion occurs from a central

Table 1

A Summary of Models Commonly Applied to Educational Change

Adoption Stages	Research and Development Model	Problem-Solving Model	Social-Interaction Model
1	Research and investigation	Translation of need to the problem	Awareness of innovation
2	Development, invention, or discovery	Diagnosis of the problem	Develop interest in innovation
3	Production and packaging	Search and retrieval of information	Needs assessment of the innovation
4	Diffusion (dissemination to mass audience)	Adaptation of the innovation	Trial of the innovation
5	Adoption and evaluation institutionalized	Trial of the innovation	Adoption of the innovation
6		Evaluation of trial in terms of needs assessment	
Summary	Passive user emphasis on research	Emphasis on user needs	Emphasis on diffusion
	Based on theories and stress development	Start with problem followed by diagnosis	Uses interpersonal networks
	Not person oriented	Relies on leadership of a change agent	Makes important use of opinion leaders

source to eventual users, and (c) diffusion is a centrally managed process of dissemination, training, and provision of resources. He argues that society and its institutions are in a continuing process of change and must learn how to understand, guide, influence, and manage these transformations. Schon further points out different levels of innovations will require different diffusion practices. For example, marginal innovations only require directed diffusion that is centrally managed as depicted in the Classical Center-Periphery Model. Schon suggests, however, that in the case of more "radical" innovation, especially in sociotechnical structures, the diffusion process and the development of the innovation evolve together with less centrally managed dissemination of information.

In spite of all the planning models available, it is still a mystery why some innovations are readily accepted and widely diffused while others are absorbed and make little real impact on education. Some theorists claim that certain characteristics are important factors in determining the extent to which innovations are adopted and implemented. Though several classifications of characteristics of innovations are presented in the literature, five characteristics are commonly reported: relative advantage, compatibility, complexity, trialability, and observability (Nichols, 1983; Havelock, 1969; Rogers, 1962; Rogers & Shoemaker, 1971). Most the theorists emphasize, however, that it is the potential users' perceptions of these characteristics, rather than the perceptions of the leaders or change agents, which affect the fate of the innovations. Rogers and Shoemaker (1971) summarized this point in the following statement: "Like beauty, innovations exist only in the eye of the beholder and it is the beholder's perceptions which influence the beholder's behavior" (p. 138).

Havelock (1969), Rogers and Shoemaker (1971), and Schon (1971) agree that the fate of an innovation not only depends upon how it is developed, disseminated, and utilized but also upon unique characteristics of the innovation. Carlson (1976), as a noted leader in the field, shares a similar view. He asserts the fate of innovations depends upon the process of diffusion which involves (a) the speed at which an innovation is diffused and (b) the extent to which it is accepted. In addition, Carlton explains that innovations are rarely installed on their merits. The main factor appears to be the relative importance attached to the anticipated advantages or threats of the change in the eyes of the persons affected (Huberman, 1973).

As educators look to improve productivity and accountability in America's schools, the literature suggests innovations--especially computer technology innovations--will require more research on adoption and diffusion practices, greater understanding of user perceptions, and more research on the potential uses of computer technology in schools. However, the fate of computer technology, as with other educational innovations, ultimately will depend upon its perceived efficiency and effectiveness in education and its rate of adoption and widespread diffusion into the traditional school structure (Carlson, 1976; Havelock, 1969; Rogers & Shoemaker, 1971).

Methodology

As stated previously, the purpose of this study was to determine current attitudes and perceptions of teachers and administrators toward the use of computer technology in schools. The problems investigated were twofold. First, the study analyzed planning, implementation, and outcomes of computer technology programs in select schools as perceived by teachers and administrators. The second aspect of the study was concerned with

current practices in school computer program development and educators' level of knowledge about computer program development. Analyses of the data should provide information for improved management of computer technology programs. The results will also provide some insight into future computer planning and inservice training for implementation of programs in schools.

Population and Respondents

The data for this study was primarily obtained from a research study conducted at The University of Akron on computer technology in select Ohio schools. Ongoing research is being conducted through the administrative computer technology classes on administrator perceptions of computer technology planning.

The schools included in this study represent all the categories of public schools in Ohio listed in the Ohio Educational Directory (1989). The sample consisted of school districts designated by the Ohio State Board of Education as "Classroom of the Future" demonstration sites for their innovative instructional programs and use of technology. The Department of Education through a formal selection process designated demonstration sites as Classrooms of the Future to develop innovative instructional programs in the State of Ohio (see Table 2). A major area of emphasis in the five-year (1985-1990) program included computer technology projects. Of the 529 respondents, 180 were elementary school teachers, 74 junior high/middle school teachers, 233 high school teachers, and 42 administrators. Table 3 shows the number of responses and percentages from teaching and administrator levels.

Instrumentation

A review of the literature provided a number of survey instruments which covered various aspects of computer usage in education--especially

Table 2

Questionnaire Distribution and Collection
by School Districts

School District	Category	Distributed	Collected
Berea City	Suburban	448	273
Butler County	Joint Vocational School District	45	15
Carrolton Exempted Village	Village	148	85
Cuyahoga Valley	Joint Vocational School District	44	25
Columbus City	Urban	40[a]	25
Ravenna City	City	170	73
Swanton Local	Rural	85	35
Totals		980	529
% returned			54%

[a]Columbus City School District has two pilot schools as demonstration sites for the "Classroom of the Future" project. Only the demonstration schools were included in this study.

Table 3

Responses and Percentages from Teaching
Administrative Levels

Level	n	%
Elementary schools	180	34
Junior high/middle schools	74	14
High schools	233	44
Administration	42	8
Total	529	100

variables accounted for a significant amount of variance in predicting the dependent variables. To accomplish the analysis, the full models were tested against the restricted Model 99. Research hypotheses were also analyzed to determine whether there was a significant difference between the ratings of teachers and administrators in predicting the dependent variables. Conclusions drawn from the significant hypotheses are discussed in the following section (see Table 4).

Results

The nine main hypotheses (1-9) examined if planning and implementation variables accounted for a significant amount of variance in predicting computer program effectiveness. Six of the nine hypotheses were supported by the data. These related to the planning areas of orientation, research, communications, support, evaluation, and outcomes for school computer program development. Further analyses of the data to determing whether teachers and administrators perceived the item differently (1a-9a) showed no significant difference on eight of the models. The two groups differed in their perceptions only on the matter of the various outcomes (see Table 4). More detailed discussion of the findings is presented below and also an examination of unique characteristics of the data.

Orientation

It is logical to assume that some of the success in implementing computer technology programs is related to what orientation takes place before school districts develop concrete plans. Hypothesis 1 was examined to determine if the level of awareness (orientation) would be helpful in predicting computer program effectiveness. The results obtained in testing Hypothesis 1 indicate that orientation for teachers and administrators is

Table 4

Summary of Hypothesis Results

Hypothesis	R^2	df	F	p	Significance
Orientation					
1	.0754	2/233	9.506	.0001	S
1a	.0074	1/374	1.773	.1838	NS
Research					
2	.0564	4/265	3.959	.0039	S
2a	.0000	1/436	.017	.8968	NS
Communications					
3	.0336	2/276	4.803	.0089	S
3a	.0006	1/451	.261	.6096	NS
Community Involvement					
4	.0002	1/255	.039	.8438	NS
4a	.0010	1.409	.404	.5252	NS
Support					
5	.0480	2/273	6.885	.00112	S
5a	.0000	1/448	.010	.9203	NS
Training					
6	.0050	1/280	1.398	.2381	NS
6a	.0000	1/454	.002	.9647	NS
Follow-up Training					
7	.0001	1/278	.023	.8795	NS
7a	.0001	1/445	.040	.8410	NS
Evaluation					
8	.0379	3/231	3.033	.0296	S
8a	.0005	1/349	.163	.6867	NS
Outcomes					
9	.1407	3/300	24.470	.0001	S
9a	.0574	1/300	18.278	.0001	S
Computer Use					
10	.1136	1/300	38.437	.0001	S

predictive of computer program effectiveness (outcomes). In actual practice, 54% of teachers and only 28% of administrators actually received orientation on potential uses of computers in schools prior to project planning.

Research

Another area examined was the research which might take place in the planning stage. Hypothesis 2 was tested to determine whether research in other school districts, other states, through state departments of education, and through colleges and universities would assist in predicting computer program effectiveness. The respondents in this study believed that overall research has a significant effect upon computer program effectiveness. Examination of the alternate types or areas of research indicated greater significant results for research conducted in other school districts. The opinion ratings pointed specifically to the importance of research in other school districts. In actual practice, respondents reported research was conducted in other districts in approximately 26% of the cases studied; in other states, 11%; in the State Department of Education, 12%; and in colleges or universities, 11% of the time.

Communications

The importance of communications with teachers and administrators in the planning process was examined in Hypothesis 3. The results indicated that overall communications may be predictive of computer program effectiveness. Separate examination of the variables also indicates significant results in communications with administrators--suggesting communications between administrators and persons involved in planning has a significant impact on program effectiveness.

The importance of communications in planning computer projects was further supported in the opinion ratings of teachers and administrators. In actual practice, respondents indicated research planning and decisions about computer projects were regularly communicated to teachers 33% of the time and to administrators 30% of the time.

Community Involvement

Hypothesis 4 was tested to determine whether community involvement would be of any value in predicting computer program effectiveness. Community involvement was not found to have a significant relationship on computer program outcomes. This is somewhat surprising in view of community impact on school reforms and public influence on school accountability. In actual practice, only 6% of the respondents indicated the community was involved in the planning process. Even at this low figure, this finding may be deceptive because two joint vocational schools were involved in the study and community participation on advisory committees is a mandated part of their curriculums.

Support

The results obtained in testing Hypothesis 5 indicated that the level of project support by faculty and administrators can help in predicting computer program effectiveness. In actual practice, respondents reported that almost 40% of administrators and over 35% of teachers rated computer hardware and software decisions as being broadly supported in their schools. The results of these findings suggest there is a strong relationship between administrator support of project decisions and computer program effectiveness.

Training

Structured training programs do not appear to be indicative of predicting computer program effectiveness. Even though 59.5% of the respondents indicated structured training programs were provided for teachers and administrators in their schools, the results of tests on Hypothesis 6 did not disclose a significant relationship between structured training programs and computer program effectiveness.

Follow-up Training

Analysis of Hypothesis 7 data indicates follow-up training does not aid in predicting computer program effectiveness. These findings were consistent with the findings on structured training programs. However, 39% of the respondents indicated follow-up training was actually continued after the initial training for pilot programs.

Evaluation

The results of analysis on Hypothesis 8 indicate the existence of product, process, and system evaluation procedures can help in predicting computer program effectiveness. Separate examination of the variables, however, indicate greater significance for the product evaluation variable. It should also be noted that in actual practice less than 15% of respondents reported evaluation procedures were developed as part of the original planning process.

Outcomes

Analysis of Hypothesis 8 indicates improvements in student, teacher, and administrator outcomes account for a significant amount of variance in predicting teacher and administrator use of computers. In separate examination of the variables the teacher variable indicated the highest ratings of improvement in the outcome section with approximately 60% of

respondents rating "a little, some, or a lot" of improvement in outcomes for teacher recordkeeping, reporting, individualized instruction, innovative teaching strategies, and teaching enthusiasm. Approximately 51% of the respondents rated improvement in teacher time management.

Overall, the outcome ratings indicated improvement was noted in most areas of outcomes for teachers, students, and administrators as a result of using computer technology. It should be noted that some respondents were uncertain about improvements in outcomes and approximately 25% of the respondents overall rated "no" improvement in outcomes for administrators, teachers, and students.

Further analyses of the outcome variable also indicated teachers and administrators rated outcomes differently when predicting computer program effectiveness (see Table 4, 9a). This finding suggests they may not perceive improvement in outcomes from the same reference point.

Computer Use

Analysis of the relationships between computer use and computer program effectiveness suggest there is a relationship between teachers and administrators using computers in their work and the success of computer programs in schools. Further, examination of the data indicated a high percentage of the respondents enjoyed using computers in their work or indicated they would enjoy using computers upon mastery of the equipment.

Summary and Implications of Findings

The literature clearly illustrates the importance of utilizing technology to improve instruction and administrative productivity in schools, but it suggests the fate of computers in schools will depend upon their efficiency and effectiveness as perceived by teachers and administrators. This point of view was reinforced as a result of the findings during

this investigation. A number of implications can be drawn from the findings of this study which may be helpful in future planning and management of computer technology programs in educational environments. The eight points listed below are the major implications from the study.

1. Orientation and awareness (knowledge) about computer innovations proved to be important predictors of the success of computer programs in schools. Survey respondents felt especially strong about providing orientation for administrators. Perhaps this result occurred because administrators make important program decisions but typically receive less orientation than teachers. These findings support traditional change theories on the process of innovations (Rogers & Shoemaker, 1971). Rogers and Shoemaker assert "knowledge" is a key stage in introducing a new innovation. Administrators and teachers should be exposed to the existence of computer innovations and gain an understanding of potential uses of computers and their functions in order to make rational adoption decisions. Both the Research and Development Model (R&D) and the Social-Interaction Change Model identify awareness as an important stage in the change process.

2. Research, particularly research in other school districts, seems to be an important component of the computer program planning process. School districts planning computer programs might wish to have key administrators and teachers do research on programs in other districts because of the credibility of data gained from peers. Review of the literature on school reforms suggests research is vital for future change and innovation in schools. The National Governors' Association 1991 Report (1986) clearly identifies the need for funding of research projects. These findings are also supported by theories on change which suggest research might increase the speed of diffusion of innovations and decrease resistance (Nichols,

1983). A key element in the R&D Model of Change is the research stage. Research is also assumed in most models adopted in education environments (Havelock, 1969; Schon, 1971). The data suggest public schools should investigate existing programs and practices before planning and implementing computer projects.

3. Communications emerged as another key factor in the planning process. Examination of the data revealed a predictive relationship between communications and computer program effectiveness and, notably, on communication with administrators. Both teachers and administrators rated communications about project decisions as important. Again, these results supported findings in the literature. Nichols' (1983) research on the role of communications in managing innovations and examination of deficiencies in communications provides an explanation for the congruent results in findings on communications with teachers. Nichols points out an effective communications system must provide two-way communications which work vertically, as well as horizontally. Carlson (1965) reported similar results in his findings on channels of communications in the adoption process. Carlson suggests both mass media and personal contact are critical in the adoption process but tend to be important in different ways and at different stages of the process. The results on communications clearly indicate a relationship exists between communications to administrators on project decisions and computer program effectiveness.

4. Surprisingly, community involvement seems to have little value in predicting computer program effectiveness. In view of the political climate in which schools operate, it would be wise for school leaders to enhance positive relationships with the community. Effective school-community relations programs have an impact on public attitudes and support for

schools. Research indicates community involvement on project committees is an excellent strategy to foster positive school and community relations (Kindred, Bagin, & Gallagher, 1984).

5. Support of project decisions appears to be an important aspect of the planning process. The findings suggest that decisions about computer hardware and software that are broadly supported are likely to result in computer program effectiveness. The implications of this finding point to the need for planners to allow sufficient time for consensus to be achieved prior to implementation. Research on managing innovations support these findings. Havelock (1969) maintains that participative involvement in decision making may be accepted as a general "law of innovation" (p. 83). Support of project decisions by teachers, however, did not indicate significant results. This inconsistency might be explained by the CERI (1983) report which suggests that, while many studies of innovation start with the assumption that greater involvement of teachers in innovation automatically produces better results and faster dissemination, there is no evidence to support this assumption. Nevertheless, the research findings and literature on managing innovative change suggest support of project decisions may decrease resistance and speed up diffusion. Certainly, the perceptions of teachers and administrators in this study support this claim.

6. Training and follow-up training were perceived as being highly important in the planning process by teachers and administrators, yet the data indicate training and follow-up training were not perceived as directly related to computer program effectiveness. There are several possible explanations for this finding. Respondents may believe that training alone

does not insure effective computer programs. The findings may also suggest that existing training programs may not satisfy the training needs of teachers and administrators.

7. This study also found the evaluation component important in planning and beneficial in predicting computer program effectiveness. The opinion responses on the importance of evaluation clearly indicate teachers and administrators perceive evaluation procedures as being an important part of the implementation process but the respondents indicated evaluation procedures were implemented in only approximately 20% of the schools. The discrepancy in these findings suggests the need for reassessment of existing evaluation procedures or in communication about such procedures. These results support findings on evaluation in the literature on traditional change and management of innovations. Evaluation is typically cited as being one of the most neglected areas in the planning process (Nichols, 1983). Nichols suggests there is a tendency to assume an innovation is good because it is new, but in education, we have responsibility to implement change that enhances learning and the efficiency of school operations.

8. The last implication suggests improved outcomes increase computer use for teachers, administrators, and students. A major characteristic which determines the extent of adoption and diffusion, according to Rogers and Shoemaker (1971), is relative advantage--the extent to which an innovation shows improvement or better outcomes than was perceived in an old activity. Participants in this study reported improved outcomes in a wide variety of areas relating to students, teachers, and administrators resulting from the use of computers in schools. The study also found a significant relationship between teacher outcomes and teacher use of computers. The findings suggest that administrators responsible for implementing

computer technology programs may reduce resistance by exposing their students, faculty, and administrative colleagues to peers in other districts who can both demonstrate and testify to the improved outcomes.

Summary/Conclusions

In this paper, an attempt has been made to examine the perceptions of teachers and administrators toward computer technology planning and implementation. Findings from the study should provide data as a framework for improved management of computer innovations in educational environments.

The paper began by discussing the computer utilization issue facing educational administrators. According to experts in the field, allocation of equipment is no longer the major issue confronting administrators. The challenge facing administrators today is managing implementation for improved adoption, diffusion, and utilization of computers in schools.

Secondly, a brief review of educational change and innovation was presented to provide the reader with further discussion as background for the paper. Next, the research methodology was discussed with descriptions of the population, instrumentation, and analysis of the data. Finally, the major results of the research project were examined as well as their implications for future management of educational innovations. Following is an overview of the major findings.

The study examined nine research hypotheses to determine if planning and implementation variables accounted for a significant amount of variance in predicting computer program effectiveness. The planning and implementation variables examined were; orientation, research, communications, community involvement, support, training, follow-up training, evaluation, and outcomes. Additional analysis was also conducted to determine if there was a significant difference in the ratings of teachers and administrators in

their predictions. Six of the nine hypotheses were supported by the data. These related to the areas of orientation, research, communications, support, evaluation, and outcomes.

Respondents rated orientation about computers in schools as an important aspect of planning for computer projects, particularly orientation for administrators. They also identified research through a variety of channels as important to the planning process. The ratings indicated research about computers in other school districts, pilot programs in other states, projects through state departments of education, and projects at colleges and universities were important for computer planning and successful implementation. A third area perceived as important in the planning process was establishing communications networks with teachers, administrators, and the persons responsible for planning and implementation decisions. The fourth category which emerged as a key element in the planning process was support of project decisions by teachers and administrators. It is important to note that the statistical analysis indicated an even stronger relationship exists between administrator support of project decisions and program effectiveness.

The final variable identified as a key element in the planning process was the category of outcomes. The statistical results indicate there is a direct relationship between improvements in student, teacher, and administrator outcomes and the use of computers. Further analysis also suggests teacher and administrator use of computers may be predictive of computer program effectiveness. Surprisingly, community involvement training programs, and follow-up training programs were of little value in predicting computer program effectiveness. However, respondents rated the variables as important for planning computer programs.

In conclusion, the literature clearly illustrates the importance of utilizing computer technology to improve instruction and administrative productivity in schools but this research suggests the fate of computers in schools will depend upon their efficiency and effectiveness as perceived by teachers and administrators. Successful adoption, diffusion and utilization of computers in education will require more than purchasing equipment. Effective program management will necessitate a systems approach to planning with inclusion of variables such as: orientation about computers in education, research on computer projects in education, designing communications networks, development of evaluation procedures and finally, strategies for successful utilization of computers.

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